

## Loader and Packaging Apparatus

### Technical Field

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This invention relates to apparatus for loading product into packages. In particular, but not exclusively, the present invention relates to a packaging apparatus for packaging product inside bags.

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### Background

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In packaging apparatus, particularly packaging apparatus in a processing line such as a meat processing line, there is a need to minimise the manual handling of product to be packaged. In a meat processing line, for example, manual handling of product is traditional but expensive. Repetitive strain injury is common. There is a strong demand for automation but because of the variety of shape and sizes of meat cuts it is very difficult for machinery to adapt to the variety of meat cuts to be packed. Machines work best with consistent product.

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In our International Publication No. WO 94/22723 an example of our packaging apparatus is described which includes a bag forming mechanism that forms bags from plastics tubing. The bags are held on a conveyor by suction and blown open by compressed air to facilitate loading of articles such as cuts of meat into the bag. A loading fork may also be provided that carries the articles and moves at least partially into the blown open bag. However, this apparatus still requires an operator to manually lift the cut and place it in the bag or onto the fork to complete the bagging process by pulling the bag over the loading fork.

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In our International Publication Number WO 02/076832, an apparatus and method for loading objects into packages is described. The apparatus includes a movable loading fork and a loading horn. The loading horn holds bags in the open position and the loading fork travels through the loading horn, thereby locating articles on the loading fork within the bag. The loading fork is inverted after receipt of a bag, to allow the bagged article to be conveyed away off the loading fork. Again, the loading horn is required to fit the bag over the fork and the cut and often between the fingers of the fork where the bag is smaller than the width of the fingers. Experience has shown that some cuts are sticky and

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others of irregular shape. It is difficult for the loading horn to hold the bag in place while the cut enters the bag. Often it is easier for the operator to pull the bag over the fork rather than use the loading horn. This restricts the speed. This apparatus may pack, in a meat packaging plant, possibly 12 meat cuts per minute.

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In many meat packaging plants a much higher speed bagging operation may be required, for example 20 cuts per minute or above.

10 Other options available to the meat industry are, for example, belt loaders where a number of small conveyor belts, say three at 25mm width each, are used to drive cuts into a bag although as the conveyor takes up space in the bag, large bag sizes are needed, thereby increasing cost.

15 Another option common in the United States of America are "stuffers" where a pneumatic ram is used to force the cut into a bag. This works very well on some cuts although not on others where the cut will fold up if pushed.

20 In our International Publication No. WO 02/053479, a loading fork and a system for transferring objects such as meat cuts off the loading fork onto a conveyor is described. This system goes some way to avoiding handling of articles after bagging, but it does not provide assistance for the actual bagging operation.

25 In referring to the above apparatus this does not suggest that any are part of common general knowledge in any country or region.

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### Objects of the Invention

30 It is thus an object of the present invention to provide a packaging apparatus and/or loader that overcomes or alleviates problems in packaging apparatus and/or loaders at present or at least provides the public with a useful alternative.

### Summary of the Invention

35 According to one aspect of the present invention, there is provided packaging apparatus including a product receiving means which is adjustable so that at least opposite sides thereof can in use be spaced apart appropriate for the width of a product

5 received therein, said product receiving means being movable relative to a bag holding means, said bag holding means having a plurality of adjustable bag holding members so that in use a bag positioned about said bag holding members can be opened sufficiently to allow the passage therein of said product receiving means with said product positioned thereon.

10 Preferably, the product means is the form of a platen having a base portion and wherein control means are adapted to control the movement of said opposite sides to provide a required amount of compression of the sides of the product.

15 Preferably, the control means are operatively connected with said bag holding means so that the movement of said sides of said platen is commensurate with an appropriate opening of said bag holding members.

20 Preferably, the control means includes biasing or pressure means acting to bias or pressure said opposite sides together until a required pressure on the sides of the product is detected.

25 Preferably, said bag holding members include a plurality of finger-like members adapted to receive thereover a said bag and to be adjustably movable apart so as to engage with an interior of said bag in opening it to receive a said product.

30 Preferably, said packaging apparatus includes an elongate support means on which said bag holding means is positioned, said product receiving means being adapted to travel longitudinally along said support means from one of its ends with a said product so that said product receiving means with said product enters into a said bag opened out on said bag holding means whereby the product receiving means and a bagged product is then able to move to an opposite end of said support means distal from said one end.

35 Preferably, a product feed means is adapted to position a said product on said product receiving means and more preferably said product feed means includes a conveyor which is adapted to be spaced apart above a said product receiving means as said product receiving means moves therebeneath, a product detecting means provided for said conveyor to control movement of the product receiving means relative to said conveyor and the movement of the product from the conveyor onto the product receiving means.

Preferably, the product feed means is adapted to pivot from a substantially horizontal position in which it receives a said product to an inclined position extending towards said product receiving means for discharging said product thereon.

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Preferably, said product feed means is a conveyor and detection of a product on the conveyor enables the movement of said product receiving means to travel beneath said conveyor and for the tipping of said conveyor into said inclined position to discharge said product onto said product receiving means.

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Preferably the apparatus has a product unloading means including a projection means adapted to engage with a bagged product being carried by a product receiving means to remove the bagged product from the product receiving means and for the bagged product to be positioned on a product exit means.

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Preferably the apparatus includes a product scanning means which measures at least the size of the product and is operatively connected at least with the bag holding means so that a size of bag commensurate with the product is provided.

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Preferably, the apparatus includes at least one bag making apparatus operatively connected with said scanning means so that a said bag is made of a size commensurate with the scanned product for this to be available on the bag holding means prior to the arrival of the product at the bag holding means.

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According to a further aspect of the invention a loader for use in the packaging apparatus defined in any one of the twelve immediately preceding paragraphs includes a product receiving means which is adjustable so that at least opposite sides thereof can in use be spaced apart so as to be appropriate for the width of a product received therein, said product receiving means being in the form of a platen.

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Further aspects of the present invention, which should be considered in all its novel aspects, will become apparent from the following description, given by way of example only and with reference to the accompanying drawings.

### **Brief Description of the Drawings**

Figure 14: Shows the apparatus of Figure 13 but in a second operational position (and with the bag making apparatus omitted).

5                   Figure 15: Shows the apparatus of Figure 14 in a third operational position.

Figure 16: Shows the apparatus of Figures 13 to 15 in a further position with the feed-out conveyor in its lowered position and about to convey the bag product onto the exit conveyor.

10                   Figure 17: Shows the bagged product being conveyed from the feed-out conveyor onto the exit conveyor.

15                   Figure 18: Shows the apparatus of Figure 17 but with the product on the loader having now been positioned within the bag

Figure 19: Shows the apparatus of Figures 13 to 18 with a feed-out conveyor in its raised position.

20                   Figure 20: Shows the apparatus of Figure 19 with the bagged product moved along the feed-out conveyor.

25                   Figures 21 to 26: diagrammatically illustrate in plan views the operation of the loader of Figures 13 to 20 as the product is inserted into a bag.

Figure 27: Shows diagrammatically the apparatus of Figures 10 to 26 but with an alternative product feed-out apparatus;

30                   Figure 28: Shows the apparatus of Figure 27 but with part of the feed-out apparatus in its elevated position.

Figures 29 to 31: Show diagrammatically various options for the operation of part of the feed-out apparatus.

### Detailed Description of the Drawings

5 The present invention relates to packaging apparatus. In particular, the present invention may have application to the provision of an automated packaging apparatus for locating product inside bags. The following description is given with reference to a particular implementation of the present invention in relation to the bagging of meat cuts. However, the present invention may also be applied to the packaging of other products.

10 Referring to Figure 1 of the accompanying drawings, a perspective view of a packaging apparatus 1 according to an embodiment of the present invention is shown. The packaging apparatus 1 includes two loaders 1A, 1B for receiving articles to be packaged and a bag receiver 2 for receiving and holding bags. The loaders 1A, 1B and bag receiver 2 are movable relative to each other and are supported on a frame 3.

15 The frame 3 includes feet 4. From the feet 4 extend legs 5 and the legs 5 at each end of the packaging apparatus 1 terminate at a cross member 6. Extending between the cross members 6 are rails 7, along which the loaders 1A, 1B may travel. A belt, chain, pulley system or other drive means (not shown) may be used to move the loaders 1A, 1B along the top of the rails 7 in direction A and along the bottom of the rails 7 in direction B. The frame 3 includes a spacer 8 to separate the ends of the packaging apparatus 1 and a brace 9 may be provided between the legs 5 if required. The rails 7 are mounted on the cross members 6 through plates 10, axles 11 and blocks 12. The rails 7 may be rotated about their longitudinal axis A. A motor belt, chain, pulley system or other drive means may drive a drive wheel 13 in order to effect this rotation. Thus, the loaders 1A and 1B 20 may move in a reciprocating action along the packaging apparatus 1 above and below the rail 7.

25 Further provided on the frame 3 is a loader clamp 14. The loader clamp 14 includes clamps 15 supported by arms 16. The separation of the clamps 15 is controlled by a ram 17. As is described in more detail herein below, the loader clamp 14 controls the width of the loaders 1A and 1B as they travel through the bag receiver 2.

30 Alternatively, loader clamp 14 may be removed from the packaging apparatus 1 and an optical scanning or other sizing device may provide sizing information to robotic bag receiver 2.

The bag receiver 2 is located on support members 18A and 18B. Support member 18B is movable vertically upwards relative to support member 18A by pneumatic rams 19. The bag receiver 2 includes two lower arms 20 attached to support member 18A and two upper arms 21 attached to support member 18B.

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Figures 2 and 3 show a top view and a side view respectively of the packaging apparatus 1.

Referring to Figures 4-6, an expanded view of the loader 1A in an open position is shown. The loader 1A includes a central support or base 22 and two arms 23A and 23B, which terminate in side flanges 24A and 24B respectively. As can be best seen in Figures 4 and 6, the arms 23A and 23B can slide into slots 25 and 26 respectively in order to allow the side flanges 24A and 24B to move inwards and outwards relative to the support or base 22. The loader 1A includes a support assembly 27 that locates the loader 1A on the rail 7. Referring particularly to Figure 6, the side flanges 24A and 24B may be connected to guide members 28A and 28B respectively, which are biased outwardly by springs 29A and 29B. When the arms 23A and 23B are moved inwardly, which may be achieved by direct pressure to either or both of the side flanges 24A and 24B and stops 31A, 31B, a ratchet (not shown) engages with teeth 30A and 30B to retain the arms 23A and 23B and flanges 24A and 24B in their position against the bias of springs 29A and 29B. Forms of catch other than a ratchet may be used, including frictional engagement or pneumatic rams provided on each loader 1A, 1B to hold the arms 23A and 23B in position. If pneumatic rams are provided on each loader, then the loader clamp 14 may be omitted, with the functions of the loader clamp 14 replaced by the pneumatic rams.

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While the loaders 1A, 1B are shown having a generally flat base and vertically extending side flanges 24A, 24B, those skilled in the relevant arts will appreciate that various other profiles may be provided. For example, the loaders may have a concave base. Also, the way that the arms 23A and 23B move together may be varied, with the use of slots 25, 26 not being essential.

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Figures 7 to 9 show the loader 1A in a fully closed position, with the separation of the side flanges 24A, 24B at a minimum. Those skilled in the relevant arts will appreciate that different structures of loaders may be made that allow increased range of separation of the side flanges 24A, 24B. However, the structure described herein is anticipated to be suitable for at least the purpose of loading meat cuts into bags.

5           In operation, the loader 1A, which is seen to be of a platen-type design, receives product from a conveyor (refer Figure 10 for example) such as, but not limited to, a tipping conveyor, a robotic tipping load conveyor, a flat conveyor, a conveyor with a photo eye to measure product length, or other product transport means (not shown) such as, but not limited to, a mechanical sweeping apparatus or a hopper situated above loader 1A. The loader may also be loaded manually. The loader 1A may commence movement along rails 7 in direction A (see Figure 1) in synchronism with the travel of the conveyor. At this stage, an automated and/or robotic soaker pad placing apparatus may place a soaker pad onto the loader 1A in the case of a meat cut. Once the product has been received by the loader 1A, it moves along rails 7 until it is adjacent to the loader clamp 14. The clamps 15 then move inwards, abutting either the side flanges 24A or 24B or stops 31A or 31B (either option can be used depending on the product width) to move the arms 23A and 23B inwards. The loader clamp 14 applies a preset pressure to the loader 1A so that the side flanges 24A and 24B apply the same pressure to the product. This may result in the product, which may be a cut of meat, changing its cross-sectional shape, allowing a smaller bag to be used. The ratchet system engages teeth 30A and 30B to retain the arms 23A and 23B in position after the clamps 15 have disengaged from the loader 1A. A benefit of a platen-type loader 1A is that the meat cut is only exposed across its top 10           surface, as will become apparent below.

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25           During this time, a bag is loaded onto a bag receiver 2. This may be achieved by an operator retrieving a bag from a bag making apparatus and manually placing the bag onto bag receiver 2 or a bag may be robotically retrieved from a bag making apparatus and robotically placed onto bag receiver 2. Once the bag has been placed over the lower arms 20 and upper arms 21, the lower arms 20 move outwards as indicated by arrows C and D to approximately the same width as the separation of the flanges 24A and 24B after they have been moved together by the loader clamp 14. Some clearance may be provided if required. The upper arms 21 then move upwards, thereby opening the bag ready for receipt of the loader 1A. The loader 1A then moves further along rails 7 through the bag receiver 2, in which case the base support 22 and arms 23A and 23B move into the bag. The loader 1A continues moving along rails 7, taking the bag off the bag receiver 2 so that the bag encapsulates the upper portion of the loader 1A and the product located thereon.

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the top of the product is exposed in the loader 1A it is much faster to place the bag over the loader 1A and product than if loading forks were used. Also contact between the product and the bag can be avoided or at least minimised.

5           Alternatively, it is envisaged that in some circumstances the bag receiver 2 may be omitted from packaging apparatus 1 and a bag retrieved robotically from the bag making apparatus and placed directly onto loader 1A.

10           When the loader 1A reaches the end of the rails 7, the rails 7 are inverted so that loader 1A is in the position that loader 1B occupies in Figure 1. In this position, the bag is held suspended from the loader 1A, at which time it may be removed from the loader 1A by way of a conveyor, including but not limited to a rise and fall conveyor, with or without exit rollers, with or without an elevation option, and possibly a rotation option or by a robotic gripper or by a fixed plate (not shown), and away from the packaging apparatus 1.

15           The loader 1A then travels back along rails 7 and is then inverted to return to its original position for receiving further product. Loader guides 32 may be provided to move the arms 23A, 23B of the loader 1A inwards as it travels back along rails in order to ensure that the loader 1A can fit through the loader clamp 14. If pneumatic rams or other drive means for are provided on each loader, then these could replace the operation of the

20           loader guides 32.

25           Alternatively, the bagged product may be removed manually from loader 1A, by an off loader or conveyor, or a combination of both, or by a robotic gripper (not shown), when loader 1A reaches the end of the rails 7 before inversion.

30           In one embodiment, the dimensions of the product are measured prior to the product being received by the packaging apparatus 1. This allows a bag of appropriate dimensions to be produced in advance. Measurement of the dimensions of the product may be achieved by an optical scanning device, located upstream of the apparatus 1 in the processing line. The bag receiver 2 may optionally also receive the product dimensions, in particular the width of the product, so that the lower arms 20 can be moved to a separation equivalent to the product width, plus some amount of clearance.

35           Alternatively, the bag making apparatus 1 may use the position of the arms 23A and 23B after they have been moved together to determine the appropriate sized bag and the bag receiver 2 may use also use that position to set the position of lower arms 20,

which may be achieved through direct mechanical engagement, by pneumatic or electronic control or otherwise. This embodiment may result in the bag making apparatus becoming the slowest operation in the processing line. However, some reduced capital costs may result by measuring the width of cuts in this way, and any delay may be reduced by increasing the length of rails 7 and increasing the separation between the loader clamp 14 (or position where the arms 23A, 23B are moved together) and the bag receiver 2.

More than two loaders 1A and 1 B may be provided with appropriate modification of the rail system on which the loaders travel to enable only the loaders at the ends of the rails to be inverted, leaving any that are part way along the rails in the same orientation. This may also assist to increase the throughput of the apparatus 1.

Referring to Figures 10 to 26 a packaging apparatus according to a further embodiment of the present invention is shown diagrammatically and referenced generally by arrow 100. This is shown with a main frame 101 having adjustable feet 121 and supporting a main beam 107 which supports a pair of loaders 103A and 103B, a product sizer assembly 108 and bag receiving means 109. The loaders 103A and 103B are interconnected by a chain or belt travelling within a frame 110 so that movement of the loaders 103A and 103B in opposite directions along the beam 107 can be achieved. The beam 107 has an end plate 117 at its drive end. The drive includes a rotational drive motor gear box 113, a linear drive motor gearbox 114, a linear drive shaft 115, and a rotational drive shaft 116, provided within a motor housing 118. A linear drive 90° gearbox 111 is shown provided on an opposite side of the end plate 117.

At the opposite end of the beam 110 is shown provided a rotary air valve 102 external of a main beam bearing 104 and a main beam end plate 105. A linear drive belt adjuster 106 may suitably be provided at this end of the beam 107. A tipping load conveyor 122 is shown in Figure 10 in its raised position, its position being controlled by a control linkage 217, suitably a pneumatic or hydraulic ram connected with valve 102. It is seen in Figure 10 that there is a clear separation between the horizontal positions of the load conveyor 122 and the loader such as 103A when it is positioned beneath the load conveyor 122.

The rotational control of the beam 110 is such that when a loader 103 reaches the end of the beam 110 (right hand end in Figure 10) carrying a bagged product, the beam

110 will rotate through 180° so that the loader 103 will then be in the position shown for loader 103B in Figure 10. Following this the bagged product can be unloaded and discharged onto a suitable exit conveyor 123. To achieve this unloading a bag unload plate 119 is shown projecting upwardly relative to the inverted loader 103B and controllable by a suitable control linkage 218, such as an hydraulic or pneumatic ram.

5 Referring now specifically to Figures 11 and 12 a suitable mounting and control assembly for the tipping load conveyor 122 is shown.

10 This is shown including a mounting post 201 providing a support for a robotic drive motor 202 provided with a drive pulley 203 and a drive belt 204. A drive shaft bearing 205 is shown provided within the drive end conveyor frame 206 including a belt support 207. A suitable support for the frame 206 will be provided such as a brace 208. Operation of the linkage 217 will result in the pivoting of the conveyor 122 from its position shown in Figure 11 to its position shown in Figure 12, this being about an axis 209. The conveyor 122 has a frame 210 extending outwardly towards a conveyor return roller 211 and an idler roller 212. A conveyor belt tensioning guide 216 may suitably be provided.

15 20 The control linkage 217 may in this embodiment be controlled by an air cylinder 214 and with top and bottom end mounts 213 and 215 respectively.

25 As shown in Figure 12, operation of the linkage 217 provides for the pivoting downwardly of the conveyor 122 which, as shown for example in Figure 14, is able to facilitate the loading of the product, such as a meat cut, onto the loader 103 which, at this time, will be positioned underneath the front end of the conveyor 122 to receive the product (see Figure 15 for example).

30 Referring particularly to Figures 13 to 26, a product such as a meat cut 300 is shown in various stages of its passage through the apparatus 100 until it exits as a bagged product 301 on the exit conveyor such as 123.

35 Referring specifically to Figure 13, by way of example only, the apparatus 100 is shown including a product identification means 302, such as an optical scanning device, which can measure the size of the product 300 and pass this information to a bag making apparatus 303, so that a bag 304 can be pre-made ready for the arrival of that particular product 300 on the sizer frame 108. The identification means 302 may for example be the

5                   CUT-SIZER (™) apparatus such as described in our international specification WO 01/89930 and the bag making apparatus 303 could include a plurality of machines of the applicant such as described in our international specification WO 94/22723. The information provided to the bag making machines 303 may suitably be such that a specific bag making machine from a gang of machines is selected, depending on the size of the product 300 which is detected, and for this purpose the bag making machines 303 may have supplies of plastic film of different widths. Additionally the information from the apparatus 302 may suitably be such that on the resulting bag 304 will be printed at its time of production, or subsequently, all required information relating to the product 300 including weight, type of cut, grade, identification of the particular carcass or animal, 10 and/or source of supply, by way of example only.

15                  After travelling through the product identification means 302 the product 300 is shown positioned on the tipping conveyor 122 where its presence is detected by a suitable detection means 305 such as a photo electric eye, although other means could be provided, such as a weight sensing means or the like. The detection of the product 300 on the conveyor 122 provides a signal for the tipping of the conveyor 122 (see Figure 14) at which time an operator manually, or an automated system robotically, will have positioned the required bag 304 over the bag holding means 109.

20                  Then in Figure 15 the product 300 is shown being tipped off the conveyor 122 onto the loader 103A which has by now been caused to travel, by a signal confirming the existence of product on the conveyor 122, to its position beneath the end of the conveyor 122. At this time also, as shown in Figure 15, the inverted loader 103B will have travelled 25 towards the left hand side of the Figure 15, engaging the unloading plate 119, which will hold the bagged product 301 as the loader 103B continues its travel towards the left hand side of Figure 15. This results in the depositing of the bagged product 301 on a rise and fall conveyor 306 forming the initial transfer portion of the exit conveyor 123, see Figures 19 and 20. Then as seen in Figure 17 the bagged product 301 will travel along the rise and fall conveyor 306 with that conveyor in its lowered position, ready for the bagged 30 product 301 to be conveyed onto the exit conveyor 123, again as shown particularly in Figures 19 and 20.

35                  In transferring the product 300 into the bag 304 by means of the sizer frame 108 and the bag receiver 109, reference may be made to Figures 17 to 20 and 21 to 26 particularly. The loader 103A in Figure 21 is shown with the product 300 positioned on it.

The loader 103A has spaced apart upstanding side flanges 124A, 124B, able to move inwardly in a direction indicated by the arrows C, D, in order to clamp onto the sides of the product 300. The base portion 125 of the loader 103A, together with the side flanges or arms 124A, 124B, essentially form a platen which, as it closes, encloses the product 300 so that only the top of the product 300 will be exposed. This is important in the case of a product such as a meat cut in that this limits the contact of the meat with the bag 304 as it is inserted, thereby reducing contamination of the bag seal area which can cause seal failures. The extent to which the side flanges 124A, 124B come together can be controlled by controlling the pressure exerted on the product 300, which pressure may be preset, but may also be controlled or influenced by the information from the identification means 302 which by sensing the original size and weight of the product 300 could determine the extent to which the product 300 could/should be compressed. In Figure 21 the product 300 on the loader 103A is shown outside the sizer frame 108 and at this time a bag 304 is shown positioned on the bag receiver 109. In Figure 22 the side flanges 124A, 124B have clamped onto the sides of the product 300.

In Figure 23 the transverse extensions or stops 126 of the loader 103A are shown engaging with the converging tapered walls 127 of the sizer frame 108 causing the sizer frame 108 to expand as indicated by the arrows S. The sizer frame 108 is linked through linkages 128 with the fingers 129 of bag receiver 109 causing the transverse divergence of the fingers 129 and either directly, or independently, also the vertical separation of the fingers 129, acting therefore to expand and open out the bag 304 to a size commensurate with the product 300 about to be inserted.

In Figure 24 the loader 103A is shown with its extensions 126 now engaged with respective side parallel walls 130 of the sizer 108 causing the full expansion of the bag 304 by means of the fingers 129 of the bag receiver 109. In Figure 25 the loader 103A has travelled with the product 300 so as to partially enter the bag 304, the bag 304 being held open by the bag receiver 109 and the walls 130 of the sizer frame 108 preferably being locked in the open position as the loader 103A travels between them. By raising the upper part of the bag 304 with the fingers 129 contact of the bag 304 with the top of the meat cut 300 may be avoided or at least minimised. Then in Figure 26 the loader 103A is shown having travelled into the end of the bag 304 resulting in a bagged product 301. At this stage the loader 103A has finished its linear travel towards the right hand side of Figure 26 and at which time the loader 103A with the bagged product 301 will be inverted into position shown in Figure 19. Also at this time the walls 130 of the sizer 108 will

commence travelling towards each other in closing up the sizer 108 and also closing up the bag receiver 109 ready for the receipt of the next bag 304 and loader 103 and its product 300.

5 As an alternative to linking the rise and fall conveyor 306 directly with an exit conveyor as in Figure 17 for example, as shown in Figures 27 to 31, the rise and fall conveyor 306, which may also be referred to as a short exit conveyor, is shown associated with a roller assembly 307. This may be mounted on a controllable telescopic ram or the like 308 in order to receive a bagged product 301 and raise it vertically and  
10 transfer it laterally as shown in Figure 28 onto a short transfer conveyor 309. As seen particularly in Figures 29 to 31 the elevating exit roller assembly 307 may also be capable of rotation so as to provide a direct lateral transfer (see Figure 29), a transfer at 270°, see Figure 30, or for example a transfer at 90°, see Figure 31.

15 Where in the foregoing description, reference has been made to specific components or integers having known equivalents, then such equivalents are incorporated herein as if individually set forth.

20 Although the above description has been given by way of example with reference to possible embodiments of the invention, it is to be understood that modifications or improvements may be made without departing from the scope of the invention as defined in the appended claims.